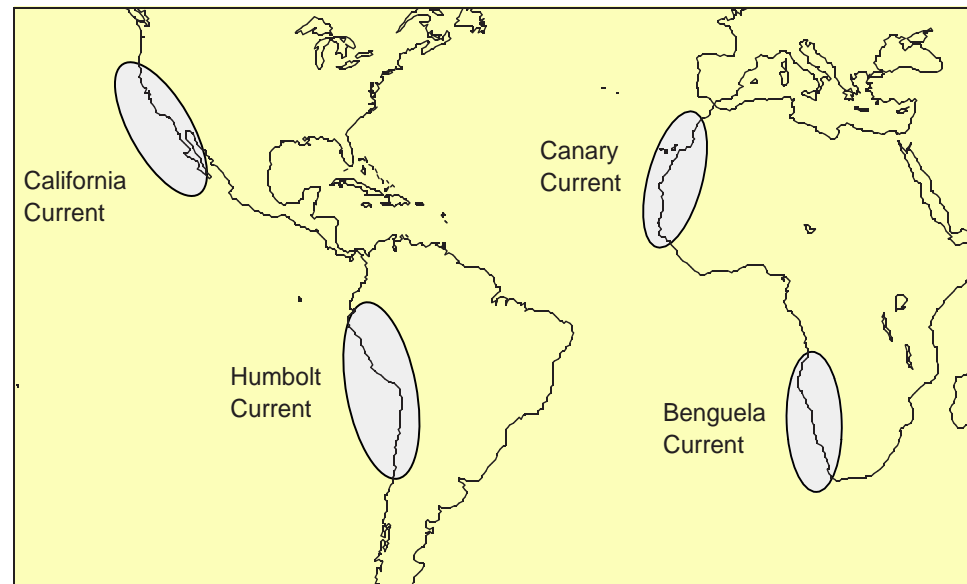


Changes in mean level, seasonal cycle and spectrum in coastal time series from eastern ocean systems

Roy MENDELSSOHN
NOAA/SWGC/PFEG
USA

Claude ROY
TOA/ORSTOM
FRANCE

**A contribution from the Climate and
Eastern Ocean System program(CEOS)**

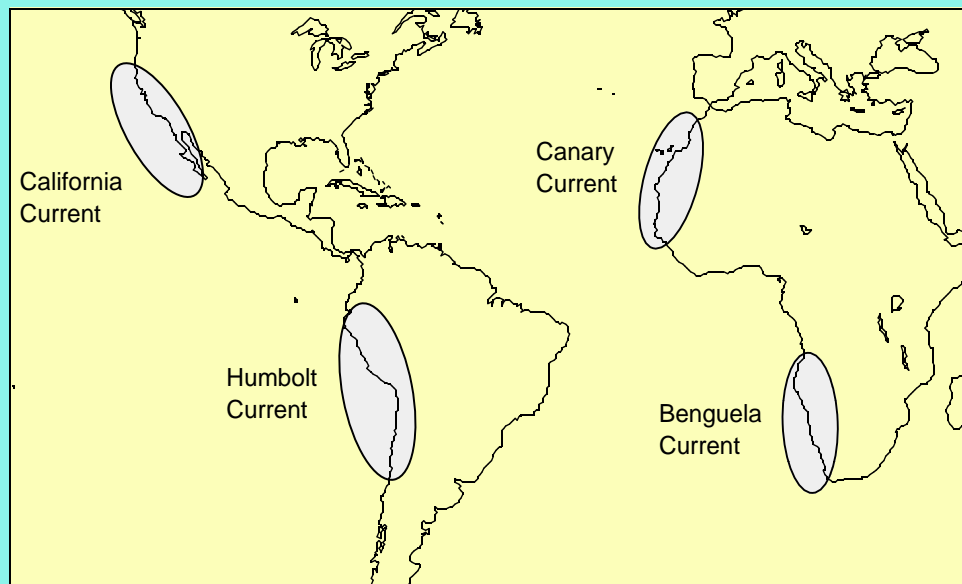


THE “CEOS” program

Climate and Eastern Ocean Systems

The dynamics of marine resources and their exploitation in face of climatic variability and changing climatic regimes

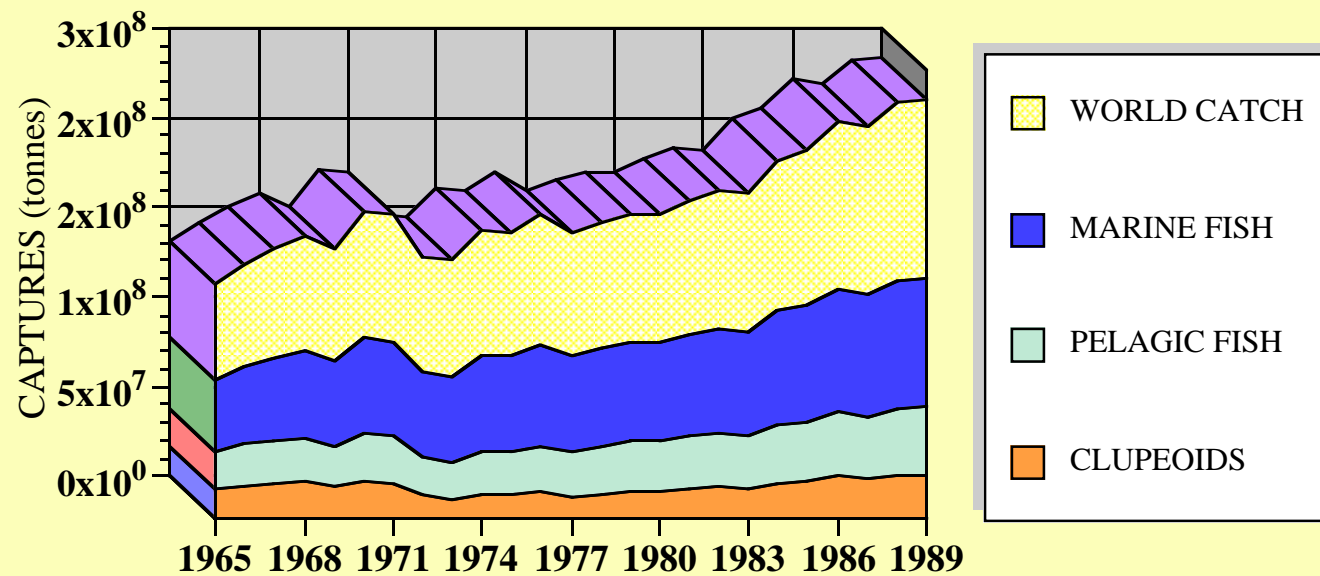
NOAA



ORSTOM

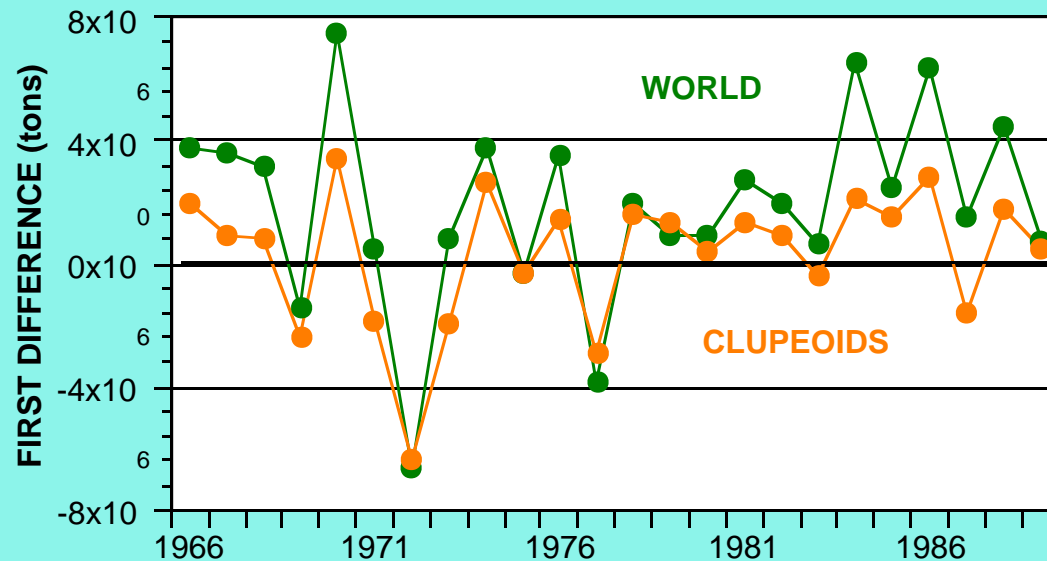
ICLARM

MARINE RESOURCES AND UPWELLING REGIONS



VARIABILITY OF MARINE RESOURCES IN UPWELLING REGIONS

The essential variability in the world fish catch is due to variability in coastal pelagic fish catches



THE METHODOLOGY of CEOS

**We can't perform experiments at the ecosystem level;
Comparison and observation are as valid scientific research methods as experimentation;
Recognize the importance of the past history in ecosystem evolution.**

- **COMPARATIVE APPROACH**

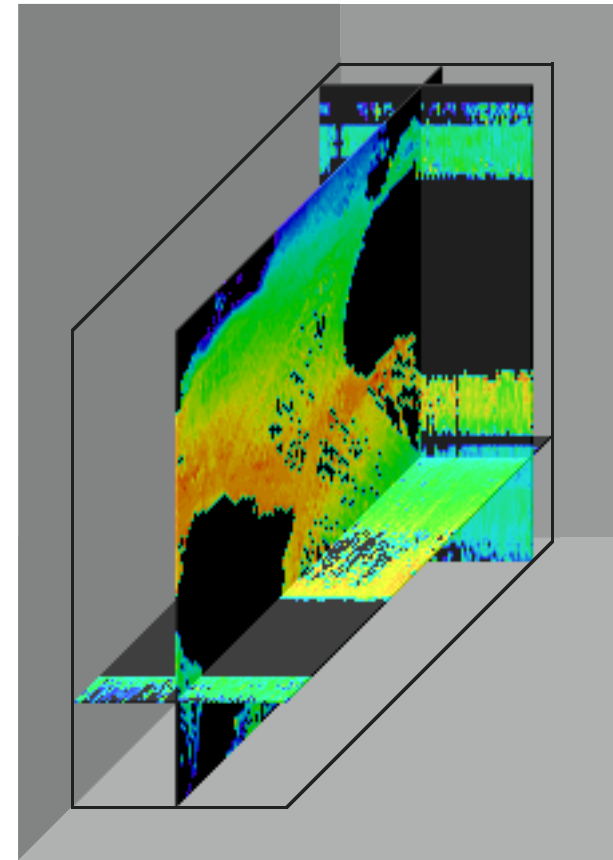
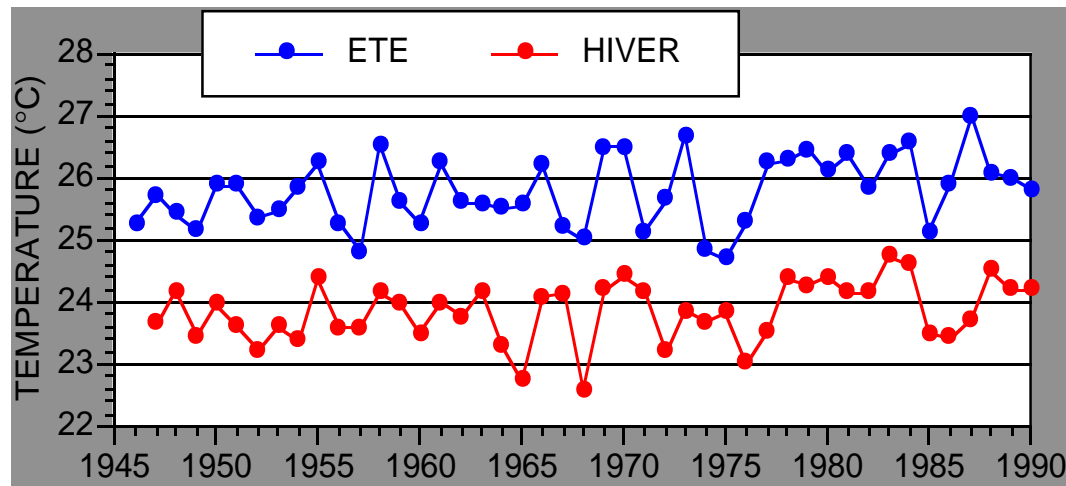
- Identify the emergent and contingent properties of ecosystems, as defined from “systems studies”;

- **RETROSPECTIVE ANALYSIS**

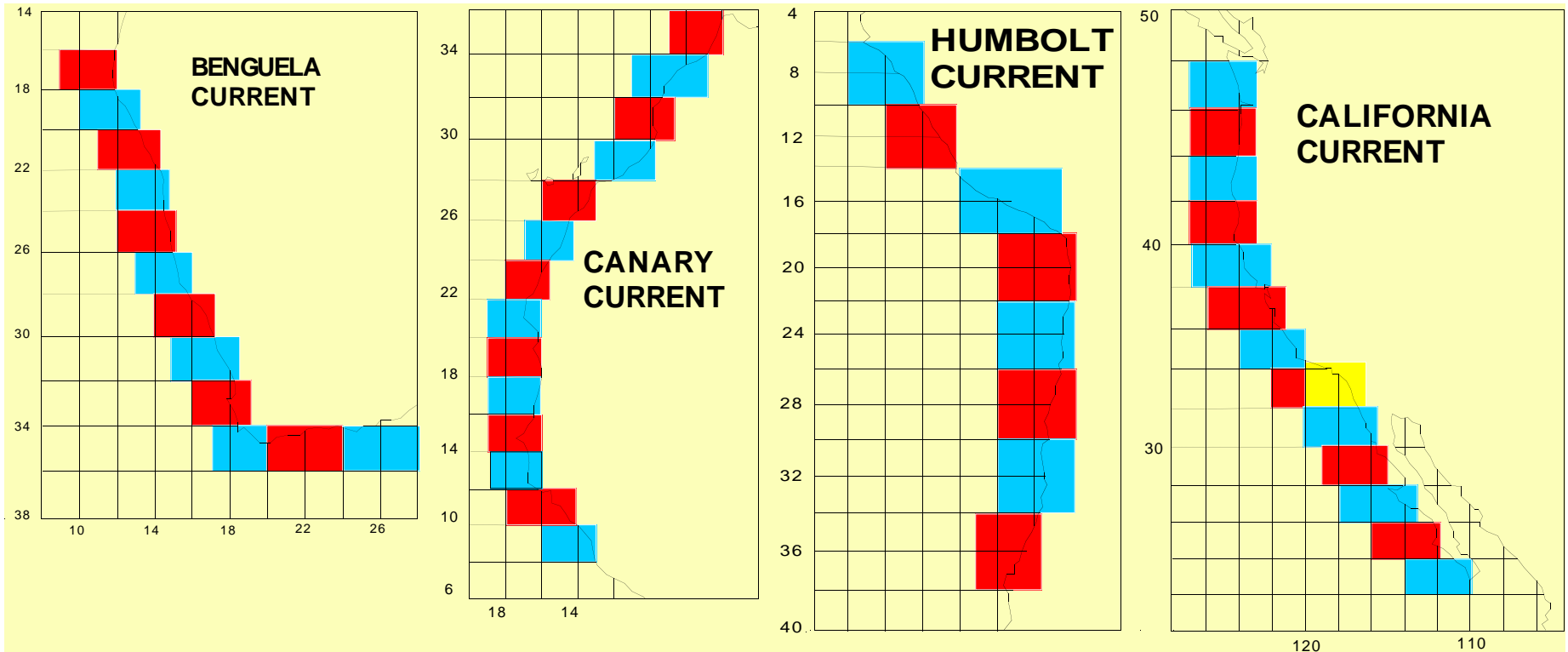
- Study the past in order to identify possible system responses due to variability and change;

The climatic variability in upwelling areas and the COADS dataset (1)

- COADS dataset : 100 millions surface weather observations distributed over the world oceans since 1854.
- This dataset allows to build time series of environmental parameters and to run comparative studies between areas.
- For CEOS program, the entire COADS dataset was tranfered to 7 CD-ROM and a program to access and summarize the data has been developped.

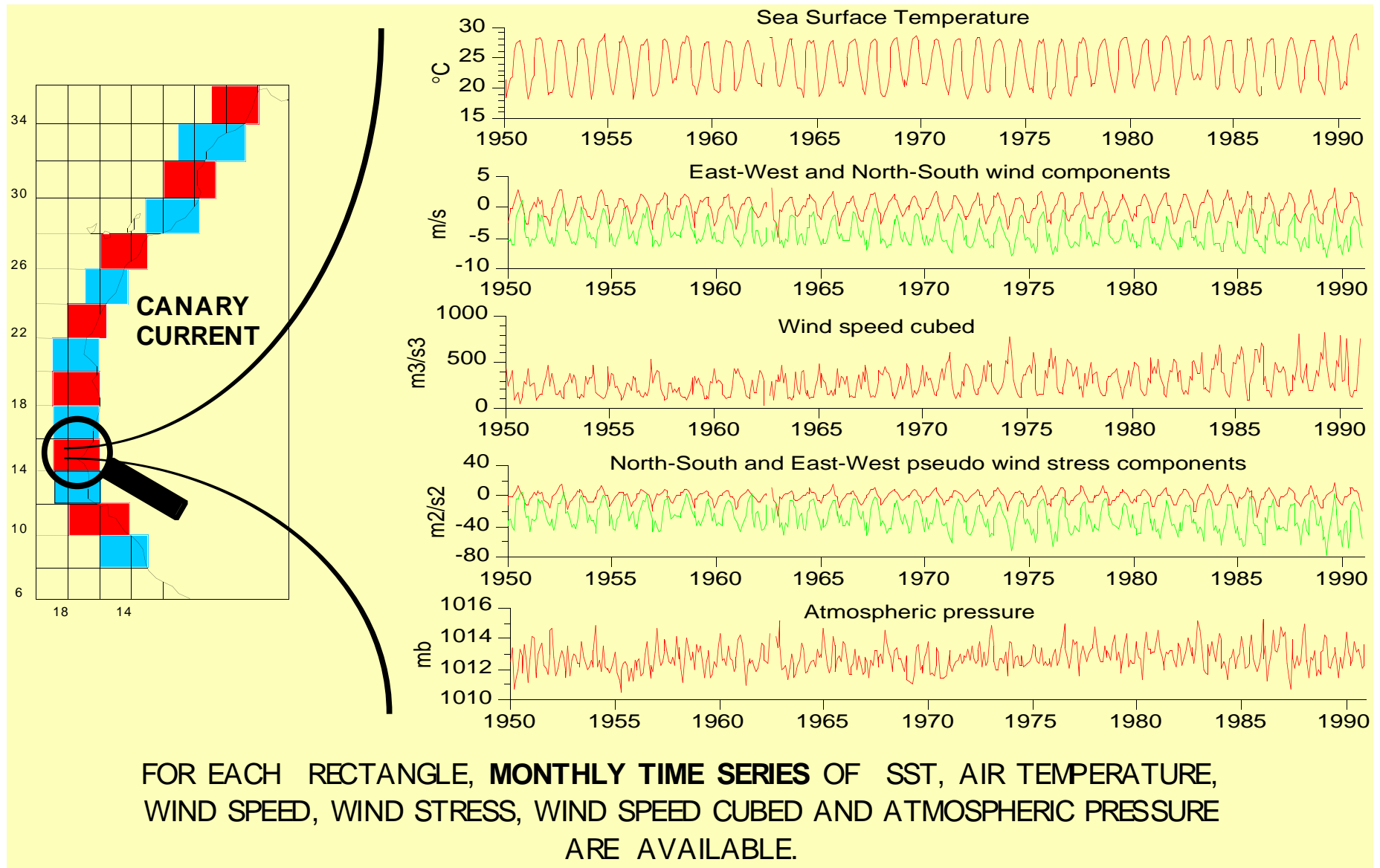


The climatic variability in upwelling areas and the COADS dataset (2)



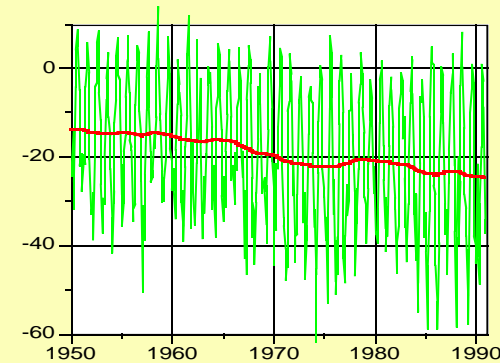
FOR THE FOUR MAIN UPWELLING AREAS, THE COADS DATA WERE EXTRACTED IN ORDER TO BUILD **MONTHLY TIME SERIES** OF ENVIRONMENTAL PARAMETERS. THE SPATIAL GRID IS DESIGNED TO TAKE INTO ACCOUNT THE DATA DENSITY (HIGH ALONG THE TRADE ROUTES) AND ALSO OCEANOGRAPHICAL AND ECOLOGICAL FEATURES. THE LATITUDINAL EXTEND IS 2° EXCEPT FOR THE HUMBOLT ECOSYSTEM WHERE IT IS 4° DUE TO THE LACK OF DATA. THE OFFSHORE EXTEND VARIES BETWEEN 2° AND 4° .

The climatic variability in upwelling areas and the COADS dataset (3)

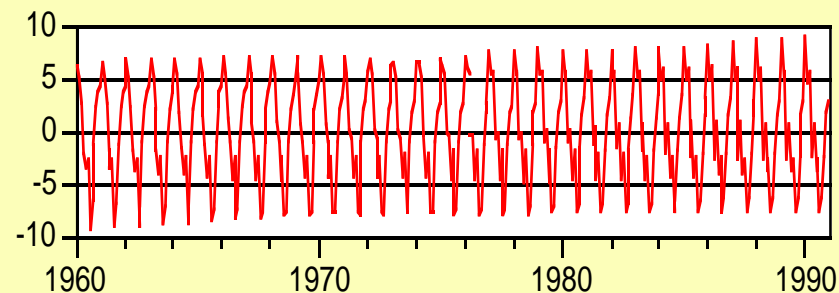


What is change ?

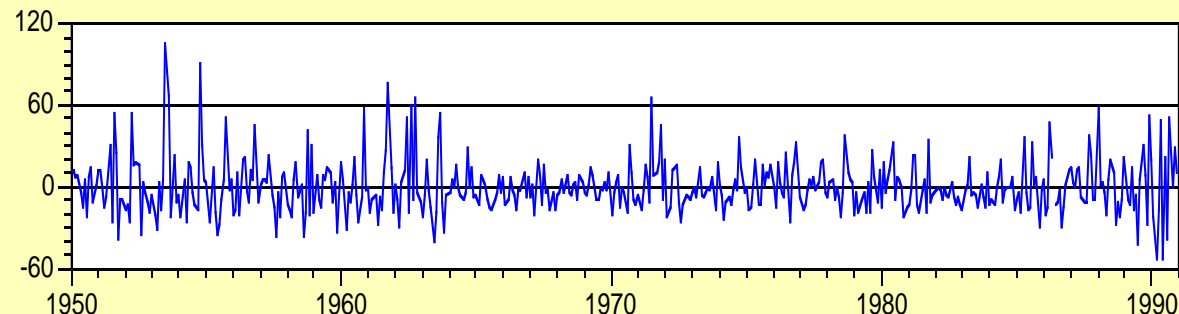
- **Change of the mean level : trend**



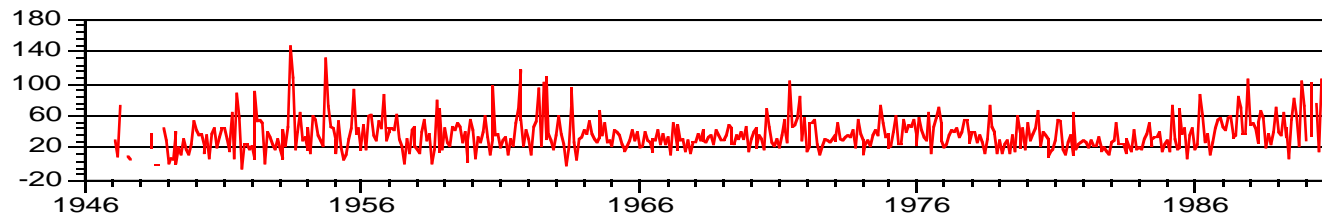
- **Change in the seasonal cycle (amplitude and phase modulation)**



- **Change in the variance structure through time**



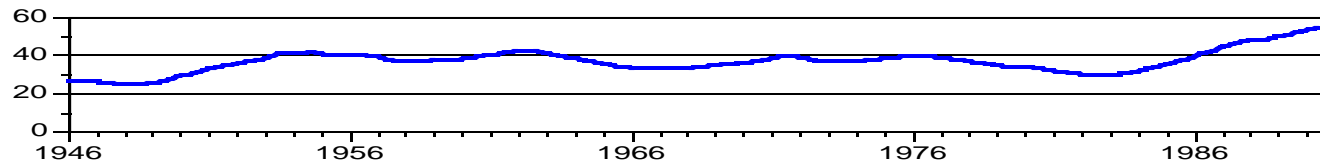
METHODOLOGY



DECOMPOSITION OF THE OBSERVED TIME SERIES

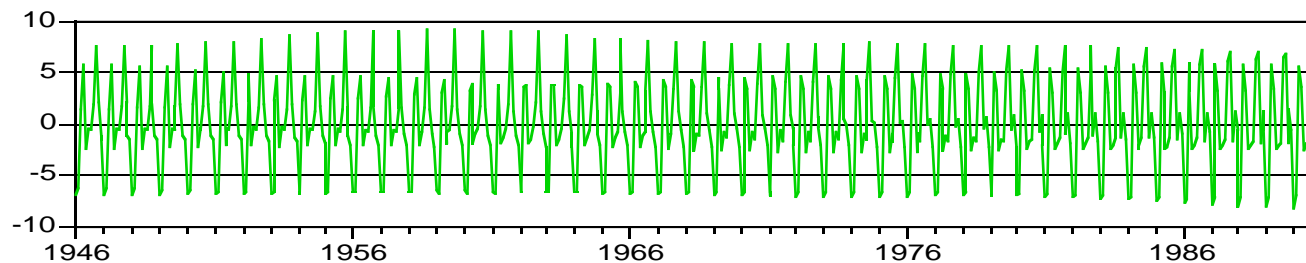
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NON PARAMETRIC TREND



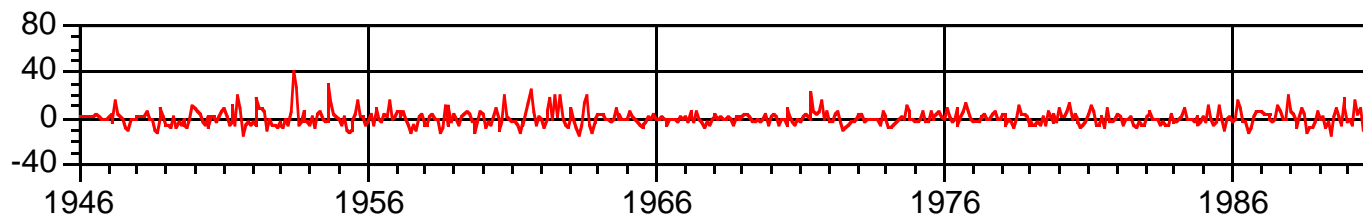
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NON STATIONARY SEASONAL CYCLE



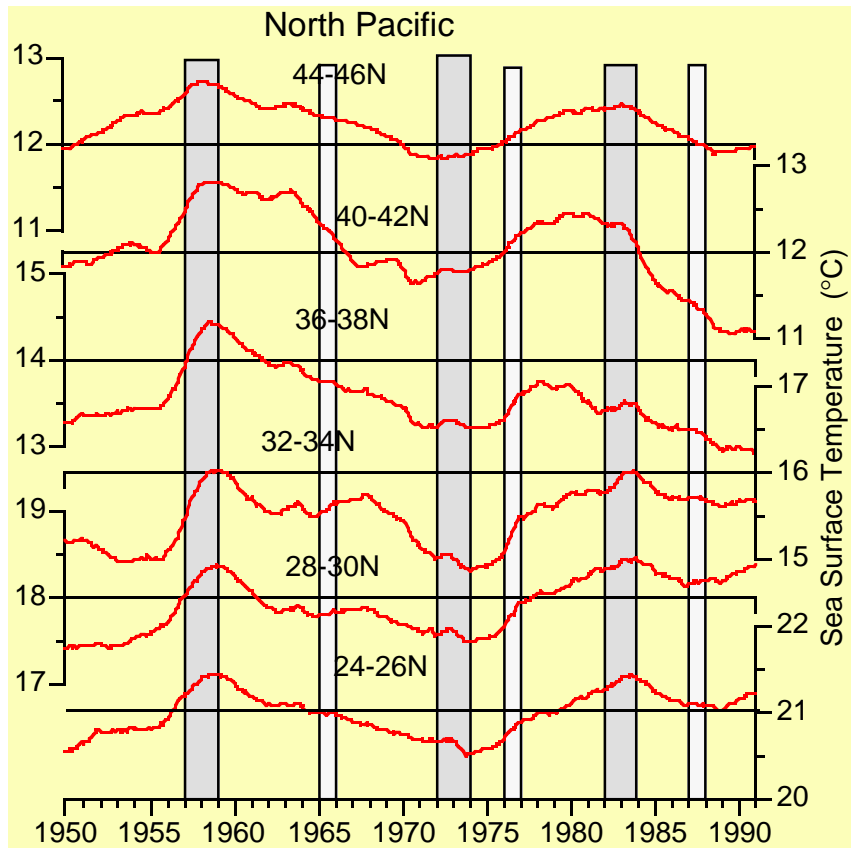
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AUTOREGRESSIVE COMPONENT



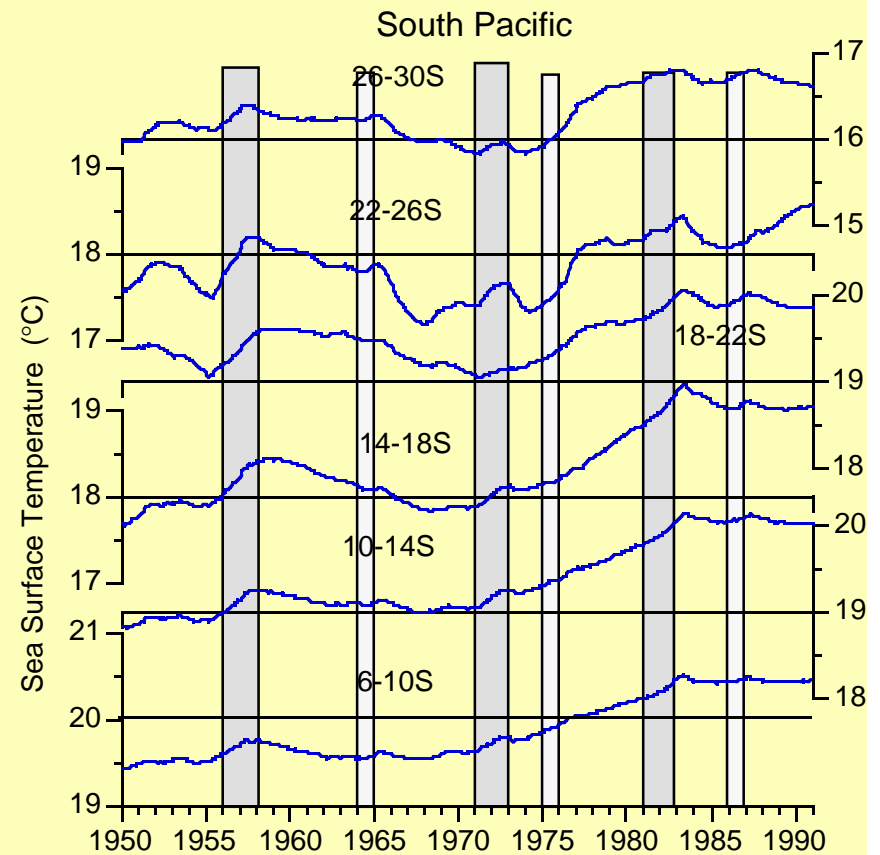
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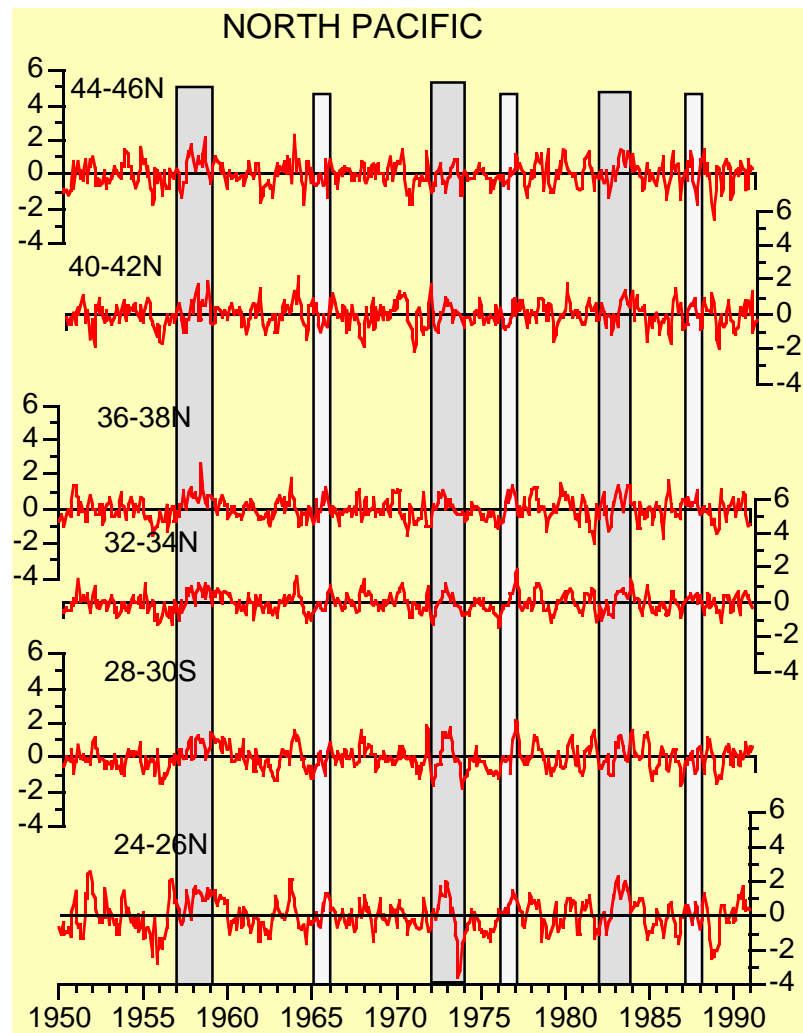
RESIDUAL COMPONENT



LONG TERM TREND

SST

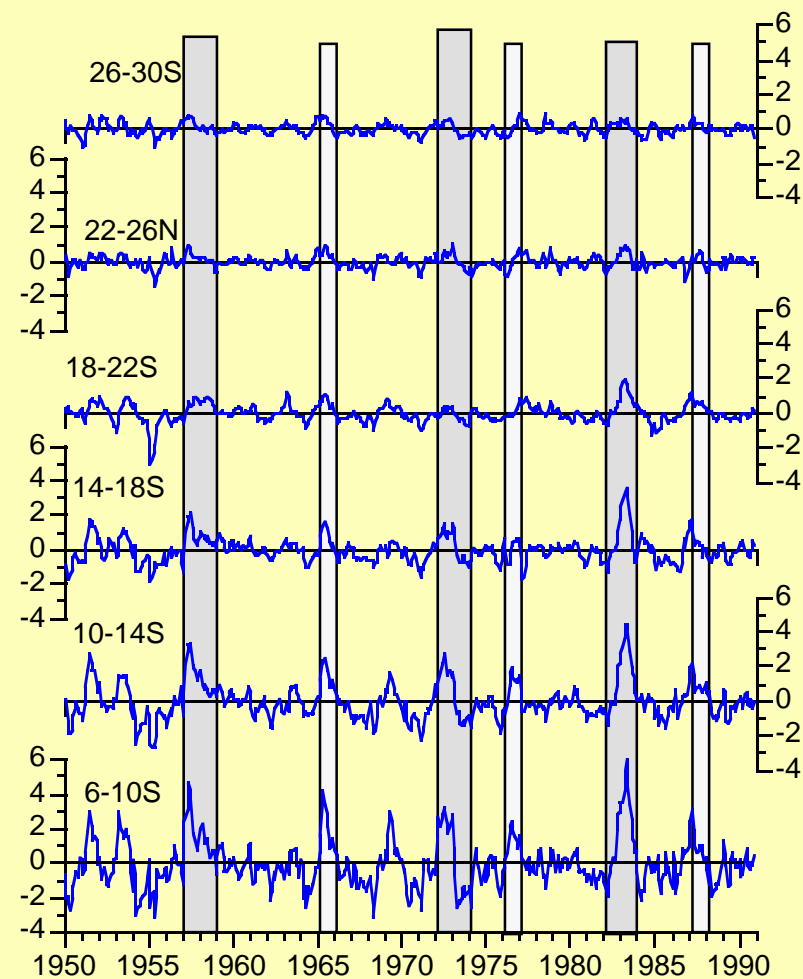




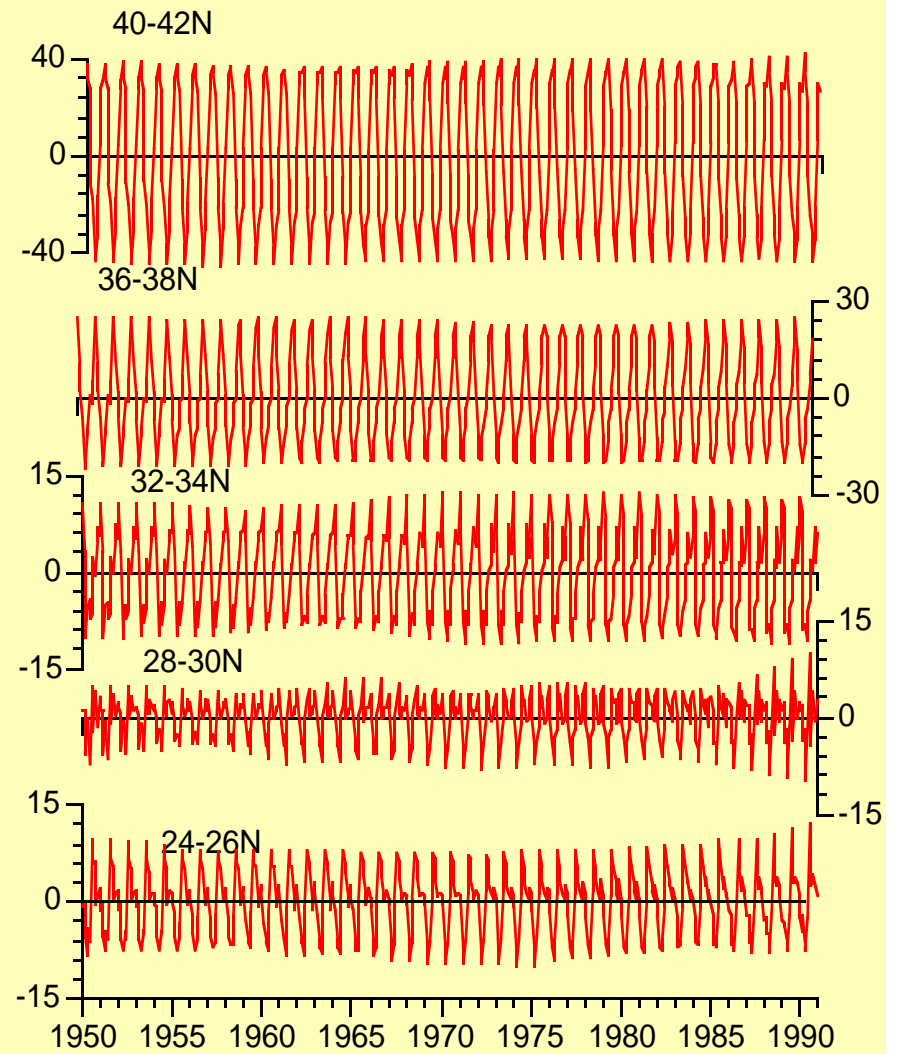
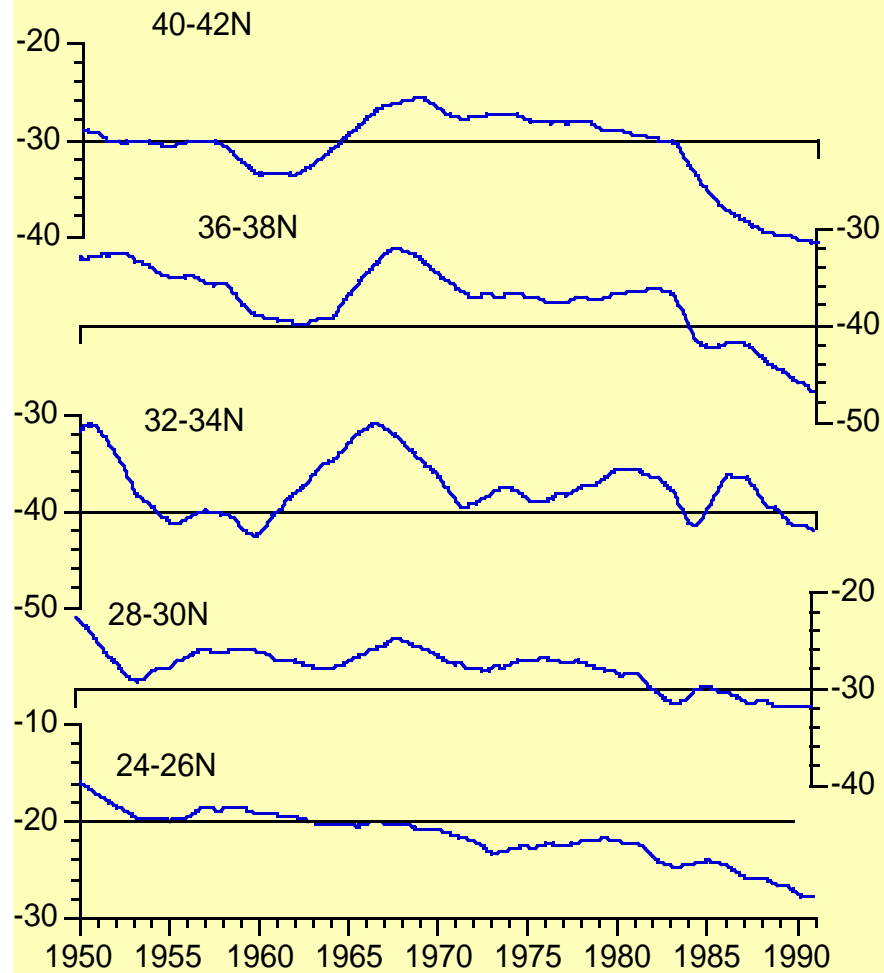
AUTOREGRESSIVE TERM

SST

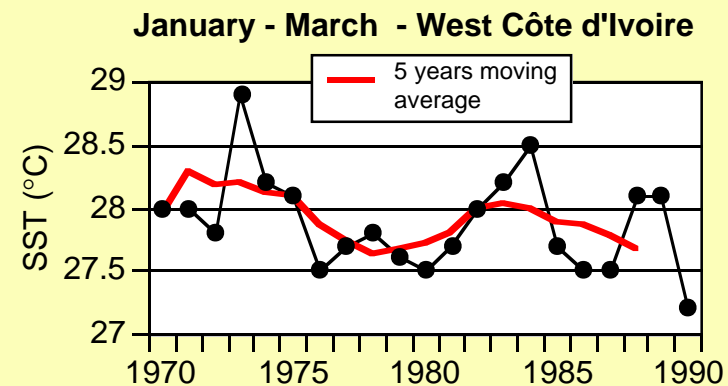
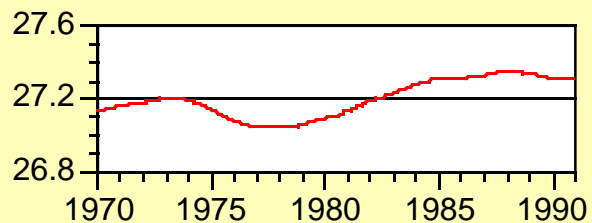
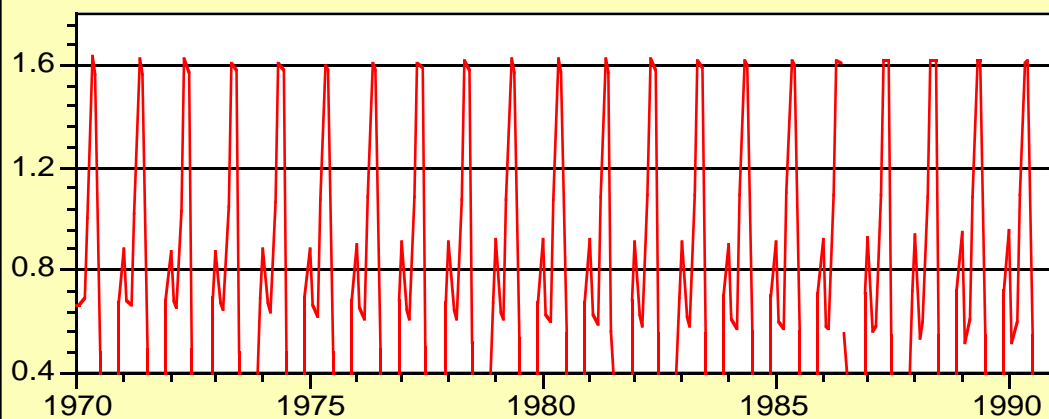
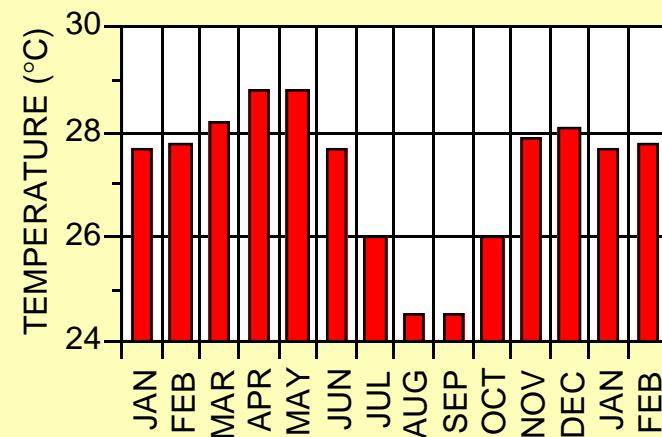
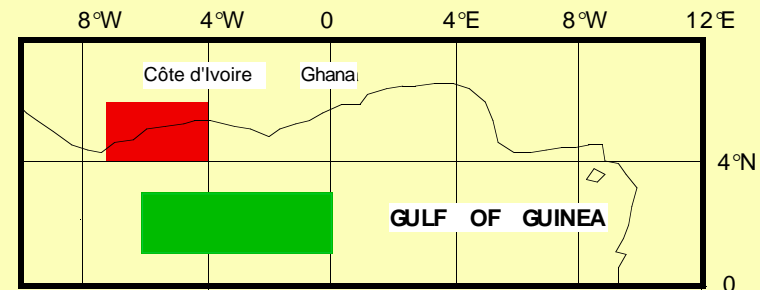
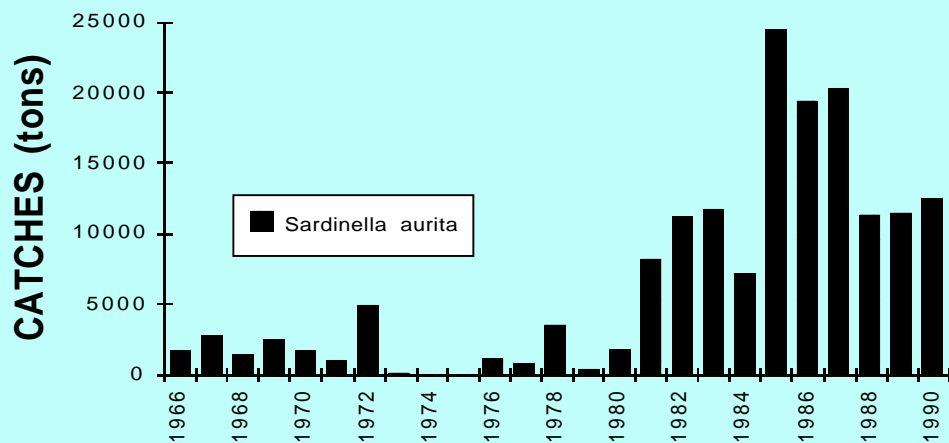
SOUTH PACIFIC



NORTH PACIFIC PSEUDO STRESS



Sardinella aurita catches



SUMMARY

SST

- Some El Nino like the 1957-1958 event induce a strong change of the trend level that last for several years both in the Northern and Southern hemisphere. It can be interpreted as a large scale oceanographic and atmospheric events perturbing the whole Pacific for several years.
- Some El Nino like the 1972-1973 event induce little perturbation of the trend but rather occur in the AR term. This can be interpreted as an event that comes and goes with little long term effect.
- The 1982-1983 ElNino has little effect on the trend. It looks like a big anomaly with little impact on long term changes.
- The SST observed during the 1976 El Nino event is much below the records high observed in 1982-1983 but this event seems to have initiated a strong lift of the long term trend.
- At low latitude (tropics), El Nino effects seems to be dominant in the AR term with little impact on the long term trend. This can be interpreted as a short lived propagating event that comes and goes (Kelvin waves ?)

SUMMARY

Wind stress

- Wind stress consistently shows an increasing trend since the mid 60's for the major upwelling areas.
- Strong perturbations of the seasonal cycle seems to occur in the Pacific. This may have a tremendous effect on the life cycle of animals which are tuned to seasonality (ie. reproduction, migration, ...)

Next step will be to look at common trends between areas and parameters in order to separate global variability from the local dynamics